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The need for more nuance in headline adult cigarette smoking prevalence estimates

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"Recent changes in the tobacco and nicotine market make it more important than ever to have valid and reliable measures of tobacco and nicotine use that capture population exposure. Due to several factors that can affect smoking prevalence estimates, there is a need for surveillance measures to be harmonised, and for reporting and interpretation to be carefully conducted."

Recent changes in the tobacco and nicotine market make it more important than ever to have valid and reliable measures of tobacco and nicotine use that capture population exposure. New smoking prevalence estimates frequently make national headlines, and are regularly used to: 1) understand the consequences of tobacco and nicotine use on public health and 2) compare estimates across jurisdictions to understand how different tobacco control policies may be affecting smoking prevalence. Here, we call attention to some problems with existing smoking surveillance measures and methods, using the example of adult cigarette smoking prevalence in the United States (US).

Several factors can lead smoking prevalence estimates to be misinterpreted or distorted. First, non-cigarette combustible tobacco products such as small filtered cigars (that are often used like cigarettes), cigars, cigarillos, pipes, and bidis are not always included in prevalence estimates. Many of these products have similar consequences for public health as cigarettes and should be included in smoking prevalence estimates. Moreover, they are often not subject to the same tobacco control measures as cigarettes (e.g., taxes, minimum pack size) and thus may be cheaper or more accessible than cigarettes. Second, the survey design underlying these estimates, including survey mode and sampling method, can affect who is included in samples, potentially under- or over-sampling certain populations and yielding estimates that are higher or lower than the true values. Third, national prevalence figures vary by the age used to define adulthood, with some surveys using 18+ and others using younger thresholds. Finally, the definition of a "smoker" in headline rates can vary as well, such as past 30 day use, daily smoking, or every day/some day smoking. Some definitions include additional conditions such as a 100 lifetime cigarette threshold, which combined with different thresholds for other tobacco and nicotine products in some cases (e.g., 50 times for cigar type products and 1 time for electronic cigarettes), further complicates interpretation(1). The public health impact of smoking and the possible effects of policies or lack thereof may be misinterpreted if these factors are not considered.

The US is one example of a country where adult cigarette smoking prevalence estimates are affected by some of these factors. Several surveys are used to measure tobacco use among US adults. We focus on the US National Health Interview Survey (NHIS) here because the US Centers for Disease Control (CDC) employs the NHIS to highlight smoking prevalence estimates in factsheets(2). A recent *New York Times* article also highlighted that US adult cigarette smoking dropped to 15% in 2015 according to the NHIS(3).

This NHIS headline figure of 15.1%, which includes every day or some day cigarette smoking and a 100 cigarette threshold, likely underestimates population exposure to combustible tobacco smoking in the US(1).The NHIS headline estimate excludes people using non-cigarette combustible tobacco products. Using annualized data from NHIS 2012-2014, we find that the prevalence of non-cigarette combustible tobacco use, including products such as cigars, cigarillos, and bidis among adults 18+ is 1.9%, with 0.8% using every day, 1.1% using some days, and an additional 4.4% rarely using (rare use is an additional response option included for non-cigarette combustible products)(4). If we consider young adults (18-24), we see the prevalence estimate is even higher at 2.7%, with 0.6% using every day, 2.1% some days, and an additional 8.8% rarely using(4). While it is possible that some proportion of non-cigarette combustible tobacco use is concurrent with

cigarette smoking, it is likely that overall combustible tobacco use prevalence for adults 18+ in the US is higher than 15.1%, and somewhere in line or just below the 2013-2014 National Adult Tobacco Survey (NATS) estimate that 18.4% of US adults aged 18+ were current users of any combustible tobacco product (defined by NATS as every day or some day use, with different thresholds of lifetime use by combustible tobacco product)(5).

Additionally, similar to other countries, US NHIS data highlight that cigarette smoking prevalence is higher in population subgroups, including sexual minorities (20.6%), those of low socioeconomic status (i.e., below the poverty level, 26.1%), and those with serious psychological distress (40.6%)(1). It is well documented that it has been increasingly difficult to recruit nationally representative survey samples in recent decades. Thus, it is possible that the US NHIS cigarette smoking prevalence estimate is low if members of groups who are difficult to engage in survey samples are underrepresented.

Comparing across another dataset, the NHIS cigarette smoking prevalence estimate (15.1%) is also lower than seen in cigarette (21.0%) smoking rates among persons aged 18+ in the 2015 National Survey on Drug Use and Health (NSDUH)(6). NSDUH's primary measure of current cigarette use asks about past-month use rather than every day or some days as used in NHIS, and unlike the NHIS does not use the 100 cigarette threshold. The NHIS estimate is low even when compared to NSDUH's prevalence estimate in persons aged 12 and older (19.4%). However, asking about past-month tobacco and nicotine product use as done in the NSDUH has been previously documented to overestimate regular use(7,8). Nevertheless, this difference in cigarette smoking prevalence illustrates how different methods can affect national prevalence estimates, making them difficult to compare not only across jurisdictions but even within countries.

The public health impact of combustible tobacco use in the US is arguably distorted by headline cigarette smoking prevalence estimates because they often exclude non-cigarette combustible tobacco use, use imprecise definitions of current smoking, and may be subject to other factors such as underrepresentation of difficult to engage groups. Cross-survey and cross-national comparisons of smoking prevalence estimates, including non-cigarette combustible products, are necessary to provide meaningful information to researchers, advocates, and policymakers. Rapid changes in the tobacco and nicotine marketplace and policy environment further highlight the need for surveillance measures to be harmonised, and for reporting and interpretation to be carefully conducted.

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